

Serial No. 09/990,640

Page 3

11. (Currently Amended) A component, comprising:  
a substrate formed of silicon nitride or silicon carbide; and  
a protective coating of crystalline composition on an outer surface  
of the substrate;  
5 the protective coating including a mixture of tantalum oxide  
(Ta<sub>2</sub>O<sub>5</sub>) and La<sub>2</sub>O<sub>3</sub>;  
wherein the La<sub>2</sub>O<sub>3</sub> concentration is in the range of about 1-10  
mol%; ~~and~~  
wherein ~~a presence of CaO is eliminated.~~
- 12-13. (Canceled)
14. (Currently Amended) A component, comprising:  
a substrate formed of silicon nitride or silicon carbide; and  
a protective coating of crystalline composition on an outer surface  
of the substrate;  
5 the protective coating including a mixture of tantalum oxide  
(Ta<sub>2</sub>O<sub>5</sub>) and an additive of at least one of Al<sub>2</sub>O<sub>3</sub> and La<sub>2</sub>O<sub>3</sub>;  
~~wherein a presence of CaO is eliminated;~~  
wherein the La<sub>2</sub>O<sub>3</sub> concentration is in the range of about 1-10  
mol%; and  
10 wherein the coating has needle-shaped La<sub>2</sub>O<sub>3</sub> - Ta<sub>2</sub>O<sub>5</sub>  
precipitates.
- 15 -20 (Canceled).
21. (Currently Amended) A component comprising:  
a silicon-based substrate;

Serial No. 09/990,640

Page 4

a protective coating for the substrate, the protective coating including tantalum oxide ( $Ta_2O_5$ ) and aluminum oxide ( $Al_2O_3$ ) for suppressing transformation from beta  $Ta_2O_5$  to alpha  $Ta_2O_5$ ; and

wherein the aluminum oxide ( $Al_2O_3$ ) concentration is as low as 11 mol% and wherein a presence of  $CaO$  is eliminated;

wherein the coating further includes an additive selected from the group consisting of carbides, borides and silicides.

22. (Previously Presented) A component comprising:

a silicon-based substrate; and

a protective coating for the substrate, the protective coating including tantalum oxide ( $Ta_2O_5$ ) and  $La_2O_3$  for suppressing transformation from beta  $Ta_2O_5$  to alpha  $Ta_2O_5$ , the  $La_2O_3$  being in the range of about 1 -10 mol% before application of the coating.

23 - 24. (Canceled)

25. (Previously Presented) The component according to Claim 22, wherein the silicon-based substrate is one of a silicon nitride substrate and a silicon carbide substrate.

26. (Previously Presented) A component comprising:

a silicon-based substrate; and

a protective coating for the substrate, the protective coating including tantalum oxide ( $Ta_2O_5$ ) and  $La_2O_3$  for suppressing transformation from beta  $Ta_2O_5$  to alpha  $Ta_2O_5$ , the  $La_2O_3$  being in the range of about 1 -10 mol% before application of the coating;

wherein the protective coating further includes aluminum oxide ( $Al_2O_3$ ).

Serial No. 09/990,640

Page 5

27. (Previously Presented) The component according to Claim 26, wherein the aluminum oxide is in the range of about 1-50 mol% before application of the coating.

28. (Previously Presented) The component according to Claim 26, wherein the aluminum oxide is in the range of about 1-50 mol% after application of the coating.

29. (Previously Presented) A component, comprising:  
a substrate formed of silicon nitride or silicon carbide; and  
a protective coating of crystalline composition on an outer surface  
of the substrate; and

5 the protective coating including a mixture of tantalum oxide ( $\text{Ta}_2\text{O}_5$ ) and  $\text{La}_2\text{O}_3$ ;  
wherein the  $\text{La}_2\text{O}_3$  concentration is in the range of about 1-10 mol%.

30. (Previously Presented) The component in claim 29, wherein the coating further comprises  $\text{Al}_2\text{O}_3$  in the range of 1-11 mol%.

31. (Previously Presented) The component in claim 29, wherein the protective coating has needle-shaped  $\text{La}_2\text{O}_3$ - $\text{Ta}_2\text{O}_5$  precipitates.

32. (Previously Presented) A component, comprising:  
a substrate formed of silicon nitride or silicon carbide; and  
a thermal protective coating of crystalline composition on an outer  
surface of the substrate; and

5 the thermal protective coating including a mixture of tantalum oxide ( $\text{Ta}_2\text{O}_5$ ) and  $\text{La}_2\text{O}_3$ ; and

Serial No. 09/990,640

Page 6

wherein a surface of the thermal protective coating has needle-shaped  $\text{La}_2\text{O}_3$ - $\text{Ta}_2\text{O}_5$  precipitates.

33. (Previously Presented) A method of protecting a silicon nitride ( $\text{Si}_3\text{N}_4$ ) or silicon carbide (SiC) substrate against repeated thermal cycles at elevated temperatures, the method comprising:

- 5     mixing  $\text{La}_2\text{O}_3$  in the range of about 1-10mol% with a quantity of tantalum oxide ( $\text{Ta}_2\text{O}_5$ ) powder;  
       preheating the mixture; and  
       applying the heated mixture to the substrate.

34. (Previously Presented) A component comprising:

- a silicon-based substrate;  
       a protective coating for the substrate, the protective coating including tantalum oxide ( $\text{Ta}_2\text{O}_5$ ) and an additive for suppressing transformation  
5     from beta  $\text{Ta}_2\text{O}_5$  to alpha  $\text{Ta}_2\text{O}_5$ ;  
       wherein the additive includes  $\text{La}_2\text{O}_3$  in a concentration in the range of about 1-10 mol% after application of the coating.

35. (Previously Presented) A method of protecting a silicon nitride ( $\text{Si}_3\text{N}_4$ ) or silicon carbide (SiC) substrate against repeated thermal cycles at elevated temperatures, the method comprising:

- 5     mixing  $\text{La}_2\text{O}_3$  with a quantity of tantalum oxide ( $\text{Ta}_2\text{O}_5$ ) powder;  
       preheating the mixture; and  
       applying the heated mixture to the substrate;  
       wherein the  $\text{La}_2\text{O}_3$  concentration before applying the heated mixture to the substrate is in the range of about 1-10 mol%.

36-40 (Cancelled)

Serial No. 09/990,640

Page 7

41. (Previously Presented) A method of applying a protective coating onto a silicon-based substrate, the method comprising:

mixing  $Ta_2O_5$  powder with  $La_2O_3$  powder to create a ceramic mixture;

- 5                   roughening the silicon-based substrate surface;  
                  degreasing the silicon-based substrate surface;  
                  preheating the silicon-based substrate to about 1000°C;  
                  applying the ceramic mixture onto the silicon-based substrate  
surface with an air-plasma spraying process;  
10                  melting the ceramic mixture;  
                  quenching the silicon-based substrate; and  
                  solidifying the ceramic mixture into a protective coating.

42. (Previously Presented) The method of claim 41, wherein the silicon-based substrate comprises silicon nitride ( $Si_3N_4$ ).

43. (Previously Presented) The method of claim 41, wherein the silicon-substrate comprises silicon carbide ( $SiC$ ).

44. (Previously Presented) The method of claim 41, wherein the protective coating thickness is in the range of about 50 microns to about 250 microns.

45. (Previously Presented) The method of claim 41, wherein the  $La_2O_3$  concentration is in the range of about 3 mol% to about 10 mol% before applying the ceramic mixture onto the silicon-based substrate.

46 -48. (Canceled)

49. (Currently Amended) A component comprising:

Serial No. 09/990,640

Page 8

- a silicon-based substrate;
- a protective coating for the substrate, the protective coating including tantalum oxide ( $Ta_2O_5$ ) and aluminum oxide ( $Al_2O_3$ ) for suppressing
- 5 transformation from beta  $Ta_2O_5$  to alpha  $Ta_2O_5$ ;
- wherein the protective coating is substantially crystalline ~~and wherein a presence of CaO is eliminated~~;
- wherein the protective coating further includes an oxide, compound, or precursor chosen from the group consisting of Hf, Si, Ln (rare
- 10 earth including whole lanthanum series and yttrium), Mg, Mo, Ni, Nb, Sr, and Ti; and
- wherein the protective coating further includes an additive selected from the group consisting of nitrides, carbides, borides and silicides.

50. (Canceled)

51. (Currently Amended) A component comprising:
- a silicon-based substrate;
- a protective coating for the substrate, the protective coating including tantalum oxide ( $Ta_2O_5$ ) and aluminum oxide ( $Al_2O_3$ ) for suppressing
- 5 transformation from beta  $Ta_2O_5$  to alpha  $Ta_2O_5$ ; and
- wherein the protective coating is substantially crystalline ~~and wherein a presence of CaO is eliminated~~;
- wherein the coating further includes an additive selected from the group consisting of carbides, borides and silicides.